

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) A method for determining a face direction of a person's face captured in a digital image, the method comprising the steps of:
processing said digital image to determine a nose axis of said face in said digital image;
processing said digital image to compute~~ing~~ digital data representing a rotation of said~~a~~ face in said~~using a single digital image based on said determined nose axis of said face, wherein a nose axis of said face in the single digital image is used to compute the rotation;~~
processing said digital image to compute~~ing~~ digital data representing a tilt of said
face using the single~~in~~ said digital image; and
determining a quantitative face direction of said face in said image~~using~~ based on said~~the data representing the computed rotation of said face in said image and said data representing the computed tilt of said face in said image.~~
2. (Currently amended) The method according to claim 1, ~~further including wherein~~
the processing said digital image to determine the nose axis of said face in said digital image comprises determining said nose axis by maximizing a correlation measure between a left side and a right side of said face from left and right sub-images of said image.

3. (Currently amended) The method according to claim 2, wherein the processing said digital image to determine the nose axis of said face in said digital image ~~determining said nose axis~~ further comprises comparing one of said left and right sides with a synthetic side derived from the other of said left and right sides using symmetry and a perspective transformation of said other side to compute said correlation measure.

4. (Currently amended) The method according to claim 3, wherein the processing said digital image to determine ~~determining said nose axis~~ further comprises applying a contrast enhancement algorithm to a nose region of said image, wherein said nose in the part of a face that reflects the most light, said reflected light being represented as a line-like region close to a real nose axis.

5. (Currently amended) An apparatus for determining a face direction of a person's face captured in a digital image, the apparatus comprising:

means for processing said digital image to determine a nose axis of said face in

said digital image;

means for processing said digital image to compute digital data representing a

rotation of said face in said digital image based on said determined nose

axis of said face ~~computing a rotation of a face in a single digital image~~

~~using a nose axis of said face;~~

means for processing said digital image to compute digital data representing a tilt of said face in said digital image~~computing a tilt of said face in said image~~; and

means for determining a quantitative face direction of said face in said image
based on said data representing the rotation of said face in said image
and said data representing the tilt of said face in said image~~using the~~
~~computed rotation and computed tilt of said face.~~

6. (Currently amended) The apparatus according to claim 5, wherein said means for processing said digital image to determine the nose axis of said face in said digital image ~~further including means for determining~~ing said nose axis by maximizing a correlation measure between a left side and a right side of said face from left and right sub-images of said image.

7. (Currently amended) The apparatus according to claim 6, wherein said means for processing said digital image to determine the nose axis of said face in said digital image ~~for determining said nose axis further includes means for comparing~~ing one of said left and right sides with a synthetic side derived from the other of said left and right sides using symmetry and a perspective transformation of said other side to compute said correlation measure.

8. (Currently amended) The apparatus of claim 7, wherein said means for processing said digital image to determine the nose axis of said face in said digital

~~image for determining said nose axis~~ applies a contrast enhancement algorithm to a nose region of said image, wherein said nose is the part of a face that reflects the most light, said reflected light being represented as a line-like region close to a real nose axis.

9. (Currently amended) A computer program product for determining a face direction of a person's face captured in a digital image, the computer program product, comprising:

computer readable program code means for processing said digital image to determine a nose axis of said face in said digital image;

computer readable program code means for processing said digital image to compute digital data representing a rotation of said face in said digital image based on said determined nose axis of said face~~computing a rotation of a face in a single digital image using a nose axis of said face;~~

computer readable program code means for processing said digital image to compute digital data representing a tilt of said face in said digital image~~computing a tilt of said face in said image;~~ and

computer readable program code means for determining said quantitative face direction of said face in said image based on said data representing the rotation of said face in said image and said data representing the tilt of said face in said image~~using the computed rotation and computed tilt of said face.~~

10. (Currently amended) The computer program product according to claim 9, wherein said computer readable program code means for processing said digital image to determine a nose axis of said face in said digital image ~~further including computer readable program code means for determining said nose axis by maximizing~~ a correlation measure between a left side and a right side of said face from left and right sub-images of said image.

11. (Currently amended) The computer program product according to claim 10, wherein said computer readable program code means for processing said digital image to determine a nose axis of said face in said digital image ~~computer readable program code means for determining said nose axis further includes computer readable program code means for comparing~~ one of said left and right sides with a synthetic side derived from the other of said left and right sides using symmetry and a perspective transformation of said other side to compute said correlation measure.

12.-46. (Cancelled)

47. (Currently amended) The method of claim ~~46-1,~~ further comprising generating ~~the a~~ plurality of quantitative face directions, wherein said generating the plurality of quantitative face directions comprises:

obtaining a plurality of digital images of ~~the~~ said face; and

for each of ~~the~~ said plurality of digital images:

processing said each digital image to determine a nose axis of said face in
said digital image

processing said each digital image to compute digital data representing a
rotation of said face in said digital image based on said determined
nose axis of said face in said each image~~computing a rotation of~~
~~the face from the respective single digital image using a nose axis~~
~~of said face in the respective digital image;~~

processing said each digital image to compute digital data representing a
tilt of said face in said each digital image~~computing a tilt of the face~~
~~in the respective single digital image; and~~

determining a quantitative face direction of the face in the ~~respective~~ said
each digital image based on said data representing the rotation of
said face in said each image and said data representing the tilt of
said face in said each image;

whereby a plurality of quantitative face directions is obtained ~~using the computed~~
~~rotation and computed tilt of the face for the respective digital image.~~

48. (Previously presented) The method of claim 1 further comprising providing a visual mouse to detect said quantitative face direction as an interface for a computer application.

49. (Previously presented) The method of claim 1 further comprising providing said quantitative face direction as input to a computer application to provide eye-to-eye contact communication in video-conferencing.

50. (Cancelled)

51. (Currently amended) The apparatus of claim ~~50-5~~, further comprising ~~means for generating the plurality of quantitative face directions, said means for generating the plurality of quantitative face directions comprising:~~

means for obtaining a plurality of digital images of ~~said~~the face; and

wherein, for each of said plurality of digital images,

said means for processing said each digital image to determine a nose axis of said face in said each digital image determines the nose direction of said face in said each digital image;

said means for processing said each digital image to compute digital data representing a rotation of said face in said each digital image based on said determined nose axis of said face computes said digital data representing a rotation of said face in said each digital image based on said determined nose axis of said face in said each image~~computing, for each of the plurality of digital images, a rotation of the face from the respective single digital image using a nose axis of said face in the respective digital image;~~

said means for processing said each digital image to compute digital data representing a tilt of said face in said each digital image computes said digital data representing said tilt of said face in said each digital image~~computing, for each of the plurality of digital images, a tilt of the face in the respective single digital image; and~~

said means for determining, for each of the plurality of digital images, a quantitative face direction of said the face in the respective~~said each~~
digital image based on said data representing the rotation of said face in said each image and said data representing the tilt of said face in said each image determines said quantitative face direction of said face in said each digital image based on said data representing the rotation of said face in said each image and said data representing the tilt of said face in said each image;

whereby a plurality of quantitative face directions is obtained using the computed
~~rotation and computed tilt of the face for the respective digital image.~~

52. (Previously presented) The apparatus of claim 5 further comprising means for providing a visual mouse to detect the quantitative face direction as an interface for a computer application.

53. (Previously presented) The apparatus of claim 5 further comprising means for providing said face direction as input to a computer application to provide eye-to-eye contact communication in video-conferencing.

54. (Cancelled)

55. (Currently amended) The ~~method~~ computer product means of claim 54-9, further comprising ~~computer readable program code means for generating the plurality of quantitative face directions, said computer readable program code means for generating the plurality of quantitative face directions comprising:~~

computer readable program code means for obtaining a plurality of digital images
of ~~said~~the face;

wherein, for each of said plurality of digital images,

said computer readable program code means for processing said each
digital image to determine a nose axis of said face in said each
digital image determines the nose direction of said face in said
each digital image;

said computer readable program code means for processing said each
digital image to compute digital data representing a rotation of said
face in said each digital image based on said determined nose axis
of said face computes said digital data representing a rotation of

said face in said each digital image based on said determined nose axis of said face in said each image;

said computer readable program code means for processing said each digital image to compute digital data representing a tilt of said face in said each digital image computes said digital data representing said tilt of said face in said each digital image~~computer readable program code means for computing, for each of the plurality of digital images, a rotation of the face from the respective single digital image using a nose axis of said face in the respective digital image;~~

~~computer readable program code means for computing, for each of the plurality of digital images, a tilt of the face in the respective single digital image; and~~

said computer readable program code means for determining, for each of the plurality of digital images, a quantitative face direction of the face in the respective~~said each digital image based on said data representing the rotation of said face in said each image and said data representing the tilt of said face in said each image determines said quantitative face direction of said face in said each digital image based on said data representing the rotation of said face in said each image and said data representing the tilt of said face in said each image;~~

whereby a plurality of quantitative face directions is obtained~~using the computed rotation and computed tilt of the face for the respective digital image.~~

56. (Previously presented) The computer program product of claim 9 further comprising computer readable program code means for providing a visual mouse to detect the quantitative face direction as an interface for a computer application.

57. (Previously presented) The computer program product of claim 9 further comprising computer readable program code means for providing said face direction as input to a computer application to provide eye-to-eye contact communication in video-conferencing.

58. (New) The method of claim 47, further comprising:
determining changes in face direction using said plurality of
quantitative face directions;
applying labels to said changes; and
parsing a sequence of said labels to determine a facial gesture.

59. (New) The apparatus of claim 51, further comprising:
means for determining changes in face direction using said plurality
of quantitative face directions;
means for applying labels to said changes; and

means for parsing a sequence of said labels to determine a facial
gesture.

60. (New) The computer program product of claim 55, further comprising:

computer readable program code means for determining face
direction changes using said plurality of quantitative face
directions;

computer readable program code means for applying labels to said
changes; and

computer readable program code means for parsing a sequence of said
labels to determine a facial gesture.